

WHAT IS CLAIMED IS:

1. A method of decomposing substances to be decomposed in which a decomposition target substance and a decomposition promoting substance having a function to decompose said decomposition target substance under irradiation with light are introduced into a decomposition area for decomposing the decomposition target substance, and those substances are contacted with each other under irradiation with light to decompose the decomposition target substance, the method comprising the steps of:
- (a) introducing said decomposition promoting substance into said decomposition area;
  - (b) irradiating said decomposition area with light; and
  - (c) introducing the decomposition target substance into said decomposition area,
- wherein the steps are started in the order of said steps (a), (b) and (c), the step (a) the earliest, at the time of starting the operation of decomposing said decomposition target substance,
- and said steps are stopped in the order of (c), (b) and (a), the step (c) the earliest, at the time of ending the operation of decomposing said decomposition target substance.

2. The method according to claim 1, wherein said

decomposition promoting substance is chlorine.

3. The method according to claim 2, wherein  
introduction of said chlorine into said decomposition  
5 area is carried out by supplying functional water  
having a function to generate chlorine in the  
decomposition area to contact the functional water with  
a gas comprised of the decomposition area.

10 4. The method according to claim 2, wherein  
introduction of said chlorine into said decomposition  
area is carried out by introducing a gas containing  
chlorine, prepared by contacting a gas supplied to an  
area storing therein functional water having a function  
15 to generate chlorine with the functional water existing  
in the functional water storage area, into said  
decomposition area.

20 5. The method according to claim 4, wherein  
introduction of said decomposition target substance and  
said chlorine into said decomposition area is carried  
out by introducing into said decomposition area a gas  
containing the decomposition target substance and  
chlorine prepared by contacting a gas containing the  
25 decomposition target substance supplied to said  
functional water storage area with said functional  
water existing in the functional water storage area.

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6. The method according to claim 5, wherein  
introduction of said decomposition target substance and  
said chlorine into said decomposition area is stopped  
by substituting a gas not containing the decomposition  
5 target substance for the gas containing the  
decomposition target substance to be supplied to said  
functional water storage area.

7. The method according to claim 4, wherein the  
10 functional water contains hypochlorous ion.

8. The method according to claim 4, wherein the  
functional water is acidic water produced in the  
vicinity of the positive electrode by electrolysis of  
15 water containing an electrolyte.

9. The method according to claim 8, wherein the  
electrolyte is at least one selected from the group  
consisting of sodium chloride and potassium chloride.  
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10. The method according to claim 4, wherein the  
functional water is a mixture of acidic water produced  
in the vicinity of the positive electrode and alkaline  
water produced in the vicinity of the negative  
25 electrode by electrolysis of water containing an  
electrolyte.

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11. The method according to claim 10, wherein the mixture is obtained by mixing the acidic water with the alkaline water at an acidic water to alkaline water ratio of 1 : 1 or lower by volume.

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12. The method according to claim 4, wherein the functional water is a hypochlorite solution.

13. The method according to claim 12, wherein the hypochlorite is at least one selected from the group consisting of sodium hypochlorite and potassium hypochlorite.

14. The method according to claim 12, wherein the functional water further contains an inorganic acid or an organic acid.

15. The method according to claim 14, wherein the inorganic acid or organic acid is at least one compound selected from the group consisting of hydrochloric acid, fluoric acid, sulfuric acid, phosphoric acid, boric acid, acetic acid, formic acid, malic acid, citric acid and oxalic acid.

16. The method according to claim 4, wherein for the functional water, the hydrogen-ion concentration (pH value) is in the range of from 1 to 4, the

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oxidation-reduction potential (working electrode:  
platinum electrode, reference electrode: silver-silver  
chloride electrode) is in the range of from 800 to 1500  
mV, and the concentration of chlorine is in the range  
5 of from 5 to 150 mg/L.

17. The method according to claim 4, wherein for  
the functional water, the hydrogen-ion concentration  
(pH value) is in the range of from 4 to 10, the  
10 oxidation-reduction potential (working electrode:  
platinum electrode, reference electrode: silver-silver  
chloride electrode) is in the range of from 300 to 1100  
mV, and the concentration of chlorine is in the range  
of from 2 to 100 mg/L.

15 18. The method according to claim 4, wherein  
introduction of said decomposition target substance  
into said decomposition area is stopped by substituting  
a gas not containing the decomposition target substance  
20 for the gas to be supplied to said functional water  
storage area.

19. The method according to claim 1, wherein the  
light includes light with wavelengths in the range of  
25 from 300 to 500 nm.

20. The method according to claim 19, wherein the

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light includes light with wavelengths in the range of  
from 350 to 450 nm.

21. The method according to claim 1, wherein the  
5 amount of the light with which the irradiation is  
carried out is in the range of from 10  $\mu\text{W}/\text{cm}^2$  to 10  
 $\text{mW}/\text{cm}^2$ .

22. The method according to claim 21, wherein the  
10 amount of the light with which the irradiation is  
carried out is in the range of from 50  $\mu\text{W}/\text{cm}^2$  to 5  
 $\text{mW}/\text{cm}^2$ .

23. The method according to claim 1, wherein said  
15 decomposition target substance is a halogenated  
aliphatic hydrocarbon compound.

24. The method according to claim 23, wherein  
said halogenated aliphatic hydrocarbon compound is an  
20 aliphatic hydrocarbon compound comprised of an atom  
substituted with chlorine atom.

25. The method according to claim 24, wherein the  
halogenated aliphatic hydrocarbon compound is at least  
25 one selected from the group consisting of  
trichloroethylene, 1,1,1-trichloroethane,  
chloroethylene, tetrachloroethylene, 1,1-

0988105-11901

dichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, trichloromethane (chloroform) and dichloromethane.

5           26. An apparatus for decomposing substances to be decomposed in which a decomposition target substance and a decomposition promoting substance having a function to decompose said decomposition target substance under irradiation with light are introduced  
10 into a decomposition area for decomposing the decomposition target substance, and those substances are contacted with each other under irradiation with light to decompose the decomposition target substance, comprising:

15           a decomposition unit comprised of the decomposition area;

          a decomposition promoting substance introduction unit (d) for introducing said decomposition promoting substance into said decomposition area;

20           a light-irradiation unit (e) for irradiating said decomposition area with light;

          a decomposition target substance introduction unit (f) for introducing said decomposition target substance into said decomposition area; and

25           a drive unit for driving said decomposition promoting substance introduction unit (d), said light-irradiation unit (e) and said decomposition target

substance introduction unit (f) individually,

wherein said drive unit starts driving said decomposition promoting substance introduction unit (d), said light-irradiation unit (e) and said

5 decomposition target substance introduction unit (f) in the described order at the time of starting the operation of decomposing said decomposition target substance,

and stops said operated decomposition target  
10 substance introduction unit (f), said operated light-irradiation unit and (e) said operated decomposition promoting substance introduction unit (d) in the described order at the time of ending the operation of decomposing said decomposition target substance.

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27. The apparatus according to claim 26, wherein said drive unit carries out said starting and said stopping in accordance with a program preset in a computer.

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28. A method of decomposing substances to be decomposed in which a decomposition target substance and a decomposition promoting substance having a function to decompose said decomposition target  
25 substance under irradiation with light are introduced into a decomposition area for decomposing the decomposition target substance, and those substances

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are contacted with each other under irradiation with light to decompose the decomposition target substance, the method comprising the steps of:

- 5       (a) introducing said decomposition promoting substance into said decomposition area;
- (b) irradiating said decomposition area with light; and
- (c) introducing the decomposition target substance into said decomposition area,
- 10       wherein the steps are started in the order of said steps (a), (b) and (c), the step (a) the earliest, at the time of starting the operation of decomposing said decomposition target substance.

15       29. A method of decomposing substances to be decomposed in which a decomposition target substance and a decomposition promoting substance having a function to decompose said decomposition target substance under irradiation with light are introduced

20       into a decomposition area for decomposing the decomposition target substance, and those substances are contacted with each other under irradiation with light to decompose the decomposition target substance, the method comprising the steps of:

- 25       (a) introducing said decomposition promoting substance into said decomposition area;
- (b) irradiating said decomposition area with

light; and

(c) introducing the decomposition target substance into said decomposition area,

wherein the steps are stopped in the order of said  
5 steps (c), (b) and (a), the step (c) the earliest, at the time of stopping the operation of decomposing said decomposition target substance.

30. An apparatus for decomposing substances to be  
10 decomposed in which a decomposition target substance and a decomposition promoting substance having a function to decompose said decomposition target substance under irradiation with light are introduced into a decomposition area for decomposing the  
15 decomposition target substance, and those substances are contacted with each other under irradiation with light to decompose the decomposition target substance, comprising:

a decomposition unit comprised of the  
20 decomposition area;

a decomposition promoting substance introduction unit (d) for introducing the decomposition promoting substance into said decomposition area;

a light-irradiation unit (e) for irradiating said  
25 decomposition area with light;

a decomposition target substance introduction unit (f) for introducing said decomposition target substance

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into said decomposition area; and

a drive unit for driving said decomposition  
promoting substance introduction unit (d), said light-  
irradiation unit (e) and said decomposition target  
5 substance introduction unit (f) individually,

wherein said drive unit starts driving said  
decomposition promoting substance introduction unit  
(d), said light-irradiation unit (e) and said  
decomposition target substance introduction unit (f) in  
10 the described order at the time of starting the  
operation of decomposing said decomposition target  
substance.

31. An apparatus for decomposing substances to be  
15 decomposed in which a decomposition target substance  
and a decomposition promoting substance having a  
function to decompose said decomposition target  
substance under irradiation with light are introduced  
into a decomposition area for decomposing the  
20 decomposition target substance, and those substances  
are contacted with each other under irradiation with  
light to decompose the decomposition target substance,  
comprising:

a decomposition unit comprised of the  
25 decomposition area;

a decomposition promoting substance introduction  
unit (d) for introducing the decomposition promoting

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substance into said decomposition area;

a light-irradiation unit (e) for irradiating said decomposition area with light;

5 a decomposition target substance introduction unit (f) for introducing said decomposition target substance into said decomposition area; and

10 a drive unit for driving said decomposition promoting substance introduction unit (d), said light-irradiation unit (e) and said decomposition target substance introduction unit (f) individually,

wherein said drive unit stops said operated decomposition target substance introduction unit (f), said operated light-irradiation unit and (e) said operated decomposition promoting substance introduction  
15 unit (d) in the described order at the time of ending the operation of decomposing said decomposition target substance.

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